

NON-LETHAL AND DISCRIMINATE WEAPONS AND TECHNOLOGIES

A POLICY PLANNING OFFICE RESEARCH SURVEY

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I. CONCEPT DEVELOPMENT

A. CHANGES IN THE INTERNATIONAL SECURITY ENVIRONMENT

Since at least the mid-1980s, and certainly accelerating after 1989, a number of startling events and new ideas have appeared which show signs of influencing both the current and future international security environment in potentially radical ways. One of these new ideas is the concept of non-lethality.

For over forty years, the national security and defense efforts of the United States and its allies were focused on the strategic threat which the USSR and its Warsaw Pact allies posed to the West. In the East, Mao's People's Republic of China posed a lesser but still worrisome threat to the US and allied interests there. With the passing of the Cold War era, the traditional strategic threats posed by the USSR, the PRC and their former allies have receded to a lesser importance. In their place, new threats to international stability and national interests have risen to concern us.

Within the global context of US and allied concerns, the region has now become the center of focus for our analytic attentions. Each region -- Latin America, Europe, Africa, the Middle East, South Asia, East Asia -- has its own unique characteristics, traditions and institutions which we must appreciate and adjust to. But while each region is unique, common strands in human nature (and the actions of states which reflect this nature) take on new prominence in our analysis of strategy, doctrine, resource requirements and our search for policy outcomes consistent with our interests and the aspirations of others. Hence, there is a new premium -- a new prominence -- to thinking and capabilities which will allow us to move beyond the realm of strategic nuclear confrontation to an era in which more options are available to decision makers and military commanders to enforce deterrence at lower levels and -- should deterrence fail -- to implement a flexible response doctrine that is proportionate to our ends and discriminatory in its effects.

Other forces have caused us to think about new options for a new international security environment. On a number of fronts, new advances in science and technology have provided (or promise to provide) new capabilities which are both suitable for and desirable in the new international security environment. Some of these capabilities, such as sophisticated electronic countermeasures and precision guided munitions, were demonstrated with dazzling effect in the execution of Operation DESERT STORM. Henceforth, their application can no longer be merely random or episodic.

As the US and its allies confront new regional security problems or threats, we are going to find that the means that we used to enforce deterrence on the USSR are inappropriate or unsuitable at the regional or national level. Indeed, we may

discover that some regional or national powers will not be deterred by "present military forces because they do not believe we [will] employ our maximally lethal weapons against them." (1)

If the credibility of our deterrent capabilities erodes, we will not be able to protect our interests -- or the interests of our friends and allies around the world. Hence, there is an urgent need to search for new options and new capabilities which will reinforce deterrence at the regional level.

The search for these capabilities is also spurred by the knowledge that the US, like so many other nations around the world, is in the process of down-sizing its military infrastructure in accordance with its new regionally-oriented defense strategy. This smaller force will find part of its mission associated with force projection and contingency response to protect our interests and ensure stability through deterrence. New advances in military technology can assist this smaller force by giving it the qualitative edge over potential adversaries at whatever level of engagement is brought. Indeed, a fervent hope among analysts is that our advanced technological capabilities will be capable of de-escalating crisis situations before they result in bloodshed.

Finally, there is an element within this mix that plays off new realities and old aspirations. Technological and scientific advances in weaponry and associated systems have reached a point where they can actually be considered "life preserving" or "life conserving", rather than exclusively destructive and fatal. With our new appreciation of regional traditions and customs in mind -- as well as a recognition of the universal abhorrence of the indiscriminate destruction and death normally associated with conflict and war -- the US is now on the verge of possessing the capability to field a new generation of weapons and technologies which will allow us to achieve deterrence at lower levels of confrontation, while concurrently ensuring that applications of force, if necessary, will both minimize loss of life and allow more discriminate targeting than has been the case before.

B. THOUGHTS ON FUTURE WAR

Another important facet in the changing international security environment is the evolutionary nature of war itself, especially current trends and their implications for war in the future. As we continue to ensure strategic nuclear deterrence at the high end of the operational spectrum, we need to plan for more useful employment modes at other levels along the operational continuum. This is necessary not just because of changes in the strategic calculus, or because of the "push - pull" phenomenon of new scientific and technological advances, but because on a day-to-day, year-to-year basis, violent confrontation at the lower end of the operational spectrum is the reality decision makers and military commanders are most likely to face in the future. According to one knowledgeable source, future war in

this changing international environment will probably be very similar to actions in Grenada, Panama and the Persian Gulf. These operations -- and operations in the future -- will likely share the following characteristics:

- o They will probably be limited in their objectives.
- o They will vary from humanitarian assistance operations, to low-intensity and regional contingency operations.
- o They will in all likelihood be of short duration.
- o They will probably involve some form of coalition warfare against an adversary.
- o They will require that we place more emphasis and attention on postwar economic recovery and reconstitution.
- o They will be aimed at restoring or ensuring regional stability.(2)

Faced with the likelihood that some future conflicts will undoubtedly compel the US and others to respond, decision makers and military commanders will have a real requirement for force employment options that allow successful force projection "without waiting for casualties to be taken to indicate an adversary's harmful intent."(3)

C. EVOLVING STRATEGIC OBJECTIVES

Some of our technological prowess in the area of non-lethality was employed during Operation DESERT STORM. However, in reality, there are very few weapons systems in the US inventory which are suited to limit both casualties and damage while concurrently allowing us to impose our will on recalcitrant adversaries. Some have argued that in order for the US to ensure the long-term strategic success of these kinds of future operations, the US "must control and limit collateral damage and casualties."(4) If we plan to retain international good will and reintegrate former adversaries back into the community of nations, we must move to "complement the existing arsenal with a new class of weapon" that satisfies these demanding politico-military requirements.(5) These weapons are important adjuncts (not replacements for) more lethal classes and types of weapons which we will still need in prosecuting future conflict situations up or down the operational spectrum. They are important weapons even if we decide not to incorporate them into our arsenal, because we will need effective countermeasures to meet similar weapons and systems entering into the inventories of military and nonmilitary organizations around the world. However, should we proceed with development, acquisition, procurement and integration of these weapons into our force structure, we do so because

these new systems will "focus on conserving life" on both sides, and will allow us to more discriminately impose our will "on threat materiel and personnel." (6)

D. CONCEPT DEFINITION

1. DEFINITIONAL CONSIDERATIONS

Officially, there is no standard, joint service definition of non-lethality or non-lethal defense. The concept is not unknown, however; it goes by different names in different services: Mission Kill in the Army; Soft Kill in the Navy, for example. Even among specialists who have studied the problem extensively, there is no single, comprehensive definition of the concept. This is both a function of its newness as well as a true reflection of the complexity of the subject matter. Thus, while the concept can be described in twenty-five words or less, there are other elements attendant to it that must be included, and therefore require additional explanation. Among the several concept definitions which have evolved on this issue, one of the clearest expressions is provided by researchers at Los Alamos National Laboratory: Non-lethal weapons and associated technology are munitions or munition systems that disable or destroy a threat's military capability without causing significant injury, excessive property destruction or widespread environmental damage. (8)

Yet much more needs to be included in this definition. For example, the span of non-lethal effects runs a wider gamut than those expressed in this description. In addition to disabling or destroying a threat target, several other types of non-lethal weapons or technologies will also allow for the disruption, degradation, or incapacitation of selected target capabilities. Inducement of any of these conditions (depending upon the type of weapon used) is a militarily explorable condition which is desirable from several perspectives, none the least of which is that it allows for the resolution of a confrontation or conflict situation without causing deliberate fatalities. While not entirely expressive of the issue, no definition or description of intended effects ever rules out lethality to targets or bystanders. No system is, or promises to be, entirely risk-free. However, what is anticipated is that employment of such systems will result in fewer needless fatalities, perhaps even among the intended targets of these systems. (There will be a wider exploration of weapons employment and effects in Part II of this paper. Related perspectives on proportionality, discrimination and the legality of such new weapons will be covered in Annex A).

Beyond a focus on the weapons and related systems themselves, a comprehensive concept definition must include consideration of the development, fielding and application of such weapons (presupposing weapons and technological research, development, procurement and integration into service inventories), as well as how such new technologies can be used to extend current

and future weapon systems capabilities into new areas not currently being explored. In addition to these elements, a comprehensive concept definition needs to include a few thoughts on the development, adoption and integration of the strategies and doctrines needed to ensure full and complete exploitation of technological capabilities under a wide range of circumstances along the operational continuum.

One reason why a comprehensive concept definition is currently not available is because there is currently no one comprehensive approach for dealing with non-lethal weapons or technologies within the government or among the Services. This and associated management issues will be discussed in more detail in Part III of this paper, but suffice it to say at this point that until a more focused approach to this new class of weapons and capabilities emerges, there will be no alternative to a composite definition. It is nonetheless useful to speculate about the parameters of such a comprehensive concept definition, should one ever come about. That being the case, the following notional definition might serve as a departure point -- or at least demonstrate the complexity of -- such an effort. Thus, non-lethal weapons and technology are those weapons, systems and technological capabilities which, when selected and employed under certain designated operational conditions, will afford the US the ability to achieve national goals and policy objectives by the judicious application of force designed to deny, disrupt, degrade, incapacitate or destroy threat materiel or personnel capabilities with a minimal loss of life and/or collateral damage.

As mentioned before, much more work needs to be invested in the construction of a comprehensive definition of the concept to reflect the subtlety and complexity of this subject matter.

2. POINTS OF DIFFERENTIATION

While there are many strands in the literature which purport to describe what non-lethality is, there are other strands in the literature which can be used to assist in differentiating non-lethality from other concepts and precepts associated with it. One prominent example is with reference to so-called "hard kill" weaponry. This term is used to describe weapons and systems whose primary purpose is to destroy a given target. "Hard-kill" has been a clear, unambiguous standard against which to concentrate policy, doctrine and acquisition energies to obtain a specific military effect.

In our fixation to develop and field hard-kill weaponry and systems, non-lethal capabilities, often available and frequently employed, have just as often been overlooked and underappreciated, at least until now. In sharp distinction to hard-kill weaponry and systems, non-lethal weapons and technology "offer unique effects or may be more cost-effective in some cases...[and] can increasingly contribute to the defeat of the hostile force...with speed, economy and reliability." (9)

However, this class of weapons and technology have not reached the same level of developmental maturity as other classes of more conventional weaponry. This is no more readily evident than in the list of several "special considerations" which developers have found are attendant upon these new systems and technologies. For example, investigators have found that in pursuing these technologies:

- o They vary in reliability.
- o They may be interesting and feasible but militarily useless.
- o Conversely, they may not be operationally feasible, interesting or affordable.
- o They may not be effective against all targets.
- o Their survivability under military conditions (especially battlefield use) is problematic.
- o They may have positive or negative synergistic effects when used with other weapons and systems.
- o Their employment may be incompatible with surrounding weapons, equipment, personnel, or operating environment.
- o Their development, possession or deployment may be legally restricted or deemed outright illegal and unlawful. (10)

So the issue remains open: While we may think we know what non-lethal weapons and technologies are, there needs to be further clarification as to what they are not. Clearly, technical characteristics are important, as are intended effects. Here we find the argument becomes somewhat fuzzy. Notionally, the term "non-lethal" conveys a literal meaning which is slightly misleading, for some of these technologies and weapons systems will prove very lethal if not to machinery and materiel, then to the people associated with them. Thus, the first person to die as a result of the application of "non-lethal" technology will certainly be looked upon with a mixture of pity and potential outrage, considering the images of Orwellian "double-speak" evoked by this situation. There is a "truth-in-labeling" dilemma which has to be addressed here, but again, such a technical conundrum can only be worked out as a result of further research and development into the concept of non-lethality as a whole.

II. WEAPONS TECHNOLOGY, CHARACTERISTICS AND EMPLOYMENT

A. PURPOSE, OBJECTIVES, AND MISSIONS

A survey of the available literature on non-lethal weapons and technologies indicates that there are a wide range of purposes, objectives and missions already ascribed to them or for which they could be prescribed. At the highest level of generality, researchers have indicated that the principal purpose for developing these technologies is to provide the US with "new capabilities that can be employed across a wide range of conflict and pre-conflict situations." (11) At the next level of detail, researchers assert that these technologies not only expand the spectrum of usable capabilities of this sort, but they thereby make available an expanded number of options for national security and military purposes. In particular, their utility in this regard is directly linked to allowing the US to "control crises and wars in the Third World." (12) While such claims are made on behalf of these weapons and technologies, they are in no way perceived to be replacements for conventional or other lethal weaponry. Indeed, it is their unique capabilities, characteristics and properties which recommend them as "powerful complements" to current military arsenals. (13) Thus, at the next higher level of detail, analysts have tried to capture and categorize the kinds of operational missions and mission activities which these weapons and technologies could potentially fulfill.

Across the operational spectrum of conflict -- from pre-crisis to post-hostilities phases -- these new weapons and technologies can be used to conduct such key missions as:

- o Incapacitation of enemy weapons systems on land, at sea, in the air and -- potentially -- in space.
- o Disruption of enemy command, control, communications and intelligence systems.
- o Degradation of enemy transportation and mobility assets.
- o Disabling enemy infrastructure elements, such as munitions or materiel production facilities.
- o Incapacitation of enemy military personnel, not just physically but also psychologically as well.
- o Disruption of enemy mobilization programs and processes. (14)

Many more such missions have been conceived and suggested, at higher or lower orders of generality -- many of these will be reviewed in subsequent sections of this paper. Suffice it to state at this point that there are quite a number of potential

applications and application points for such weapons and technologies.

B. WEAPONS AND SYSTEMS CHARACTERISTICS

A further investigation of these weapons and technologies discloses some operational characteristics which make them of more than passing interest to even the casual observer. For one thing, as has been suggested before, these weapons and technologies seem to promise to "fill a vacuum between diplomacy and lethal force in regional conflicts." (15) Concurrently, they "offer the user choices of damage to be caused" -- a not inconsiderable option, especially when contemplating the revitalization of a truly robust flexible response posture. (16) In this regard, the US would be in possession of weapons and technological capabilities which could be "designed to have the capability to incapacitate threat materiel and personnel without intentionally inflicting lethal damage." (17)

Taken in light of the half-dozen or so nominal missions in which these capabilities could be used, systems and technologies such as these can be seen as "leveraging the natural weaknesses" in target materiel, infrastructures and personnel to the user's distinct advantage. The payoff, according to one keen insight, is that these weapons and technologies offer us the capability to affect the adversary's military force potential "before it has reached the point of battle, as well as once the battle is joined." (18) While not offering the decision maker or military commander a golden bullet (or even a "sure thing") as they try to resolve or de-escalate a crisis, these new weapons and technologies promise to add new force options and capabilities which were hitherto unavailable.

C. OPERATIONAL ADVANTAGES AND DISADVANTAGES

Researchers who have examined non-lethal weapons and technologies have generally considered them advantageous; indeed, according to one source, these weapons and technologies have the potential to make "major advances in our national defense capabilities by enhancing our physical security and economic strength." (19) One principal advantage they convey is that they will give "the National Command Authority and the commander in the field additional options for projecting force against the evolving threat." (20) Linked to the expansion of decision maker options is the perception that such weapons and technologies can make positive contributions to "channel conflicts away from lethal engagements...[allowing us to] proactively control the situation and guide edge-of-conflict situations back from the edge." (21)

Other advantages that these weapons and technologies convey are evident at the operational level of engagement. For example, these technologies will allow the user to:

- o Achieve power and force projection without inflicting needless casualties.
- o Implement more effective point defense of embassies, consulates and other critical, exposed installations.
- o Increase the effectiveness of civil disturbance measures, law enforcement and counter-terrorist/narcotics operations.
- o Achieve credible deterrence at an earlier stage in a crisis.
- o Achieve military surprise.
- o Create uncertainty in an adversary or undermine his confidence.
- o Defeat enemy weapons systems or targets beyond the range of conventional weapons.(22)

This list is only a partial enumeration of the kinds of strategic, operational and tactical advantages which these systems and capabilities offer.

Equally as important, however, are disadvantages which have been associated with these weapons and technologies. Among the more prominent are the following, which stipulate that these capabilities

- o May require stringent command and control over their use.
- o May require unique self-protection measures.
- o May create unique equipment signatures or force configurations.
- o May unduly interfere with some conventional systems.
- o May result in increased training and doctrinal requirements.
- o May not be suitable against all targets.
- o May not perform properly or be effective under certain climatic or atmospheric conditions.(23)

This list, too, is only partial, and provides only some of the potential disadvantages associated with these weapons and technologies. A comprehensive accounting of both advantages and

disadvantages has yet to be compiled and may be only available as a result of a more purposeful and centralized research effort.

D. EMERGING TECHNOLOGICAL AREAS

There are numerous lists of new and emerging non-lethal weapons and technologies. Indeed, such extended and extensive listings quickly reach a point somewhere between saturation and diminishing returns as they relate to usefulness or practicability. This is not necessarily a criticism as much as an observation on the richness and diversity of the systems and technologies associated with this concept.

In an attempt to simplify the analysis and broaden the appreciation of this wide-ranging field, we will merely offer a series of the major technological categories which are recurrent in the literature. Thus, reference is frequently made to new non-lethal advances and capabilities in the fields of:

- o Electromagnetics, including:
 - oo Compact power sources
 - oo Pulse power
 - oo Directed energy
- o Materials, including:
 - oo Non-lethal chemicals
 - oo Adhesives
 - oo Abrasives
 - oo Super-acids
 - oo Reagents
 - oo Lasers
 - oo Taggants
- o Bioengineering, including:
 - oo Microbiology
 - oo Multi-agent microspheres
- o Kinetics, including:
 - oo Explosive non-nuclear electromagnetic pulse (EMP) generators
 - oo Advanced computer simulations
- o Acoustic Projection
- o Telerobotics and Autonomous Delivery Systems (24)

Again, not meant to be exhaustive, the list merely illustrates the breadth of current research and development and the applications which have evolved within each of these

principal areas. But these systems and technology categories are not just what is novel in these developments; of considerably more interest are the effects which these capabilities offer which make them attractive. These will be described in more detail below.

E. VARIETIES OF WEAPONS EFFECTS

To illustrate the potential which these and other representative non-lethal weapons and technologies have, the following summary assessments of their intended effects is provided.

1. ELECTROMAGNETIC SYSTEMS (EM). New EM systems are based on the use of directed electromagnetic energy and light, running from visible light to infrared, millimeter waves, microwaves, x-rays, lasers and isotropic radiators. They are designed to damage target EM systems, components, subcomponents or "other sensitive electronic equipment in a manner that does not cause catastrophic damage to the system but still renders [it] combat ineffective." EM systems, such as those described here, would induce mechanical damage, overheating or current fluctuations, causing temporary to permanent damage, both to equipment and the personnel operating it. EM systems are important because they contribute directly to our electronic warfare and electronic countermeasures capabilities and are designed "enhance weapons systems survivability or lethality" by defeating adversary EM/counter-ECM systems. (25)

2. MATERIALS TECHNOLOGY. Materials technology is related to chemical developments. These capabilities are used to inhibit, degrade, incapacitate or prevent normal system, human, human-materials, or materiel-component functioning. They produce or make use of asphyxiating, poisonous, corrosive or debilitating gases, irritants, flames, adhesives, lubricants, or inhibitors to achieve their effects. These technologies can be used to target fuels, seals, rubber, engine air intakes, to cause metal fatigue, electronic short circuits, optical defeat, as well as for area or installation denial. These technologies have the potential for being lethal to humans since they "generally cause damage or impairment of body organs." Related to these technologies is "taggant" technology, by which materials can be used for arms control verification, for tracking critical materials, or even for tracking individuals. (26)

3. BIOENGINEERING. Perhaps the most controversial of all new technologies, bioengineering advances have spawned new bacteria, viruses, toxins and other substances which can be used to disable enemy personnel "by the rapid onset of disease or debilitation of functions", rendering them "unable or unwilling to perform their intended military function or mission." There are currently "no practicable anti-materi-

el...effects" from these technologies but future capabilities are a real possibility. Currently, the US is prohibited by domestic and international law from deliberate use of such technologies as weapons, however, research and development in this area needs to continue simply because of the threat posed by other states which may not observe international constraints on the use of these agents, and may actually be pursuing these technologies for their own military applications. (27)

4. KINETICS. Kinetic technologies include a wide range of passive and active capabilities, associated with entanglements, blast and ballistic effects, which are designed to cause physical, mechanical or structural damage to materiel or personnel by means of fouling moving parts, use of rapidly increasing air pressure or penetrating effects, to render the target unusable for its intended purpose, or precipitate its self-destruction based on these effects. Violent anti-materiel kinetic effects, such as crushing, overturning, deforming, blasting or spalling, could be potentially lethal to humans operating in or around such a target. (28)

5. INFORMATION SCIENCES. Basically, new capabilities in this expanding technology area focus on information perturbation, which would allow for the implantation (or defense against) computer "viruses" or similar "remote triggers" which, if introduced, could cause massive equipment and system failures. Other advances, such as those in simulation technology, could result in the use of holography to produce certain psychological and visual effects. (29)

6. ACOUSTIC/SONIC PROJECTION. Research work in this area has focused on sensors, and on how sound waves could be applied in a number of situations to disrupt, disorient, or induce debilitating effects on humans (singly or in groups) by interfering with balance or other organ functions, or by repulsion. Some of these effects can be accomplished by the use of ultrasound (30 Hz or below), while repulsion would be accomplished by generation of very strong sound waves or signals, which might also be strong enough to cause damage to equipment. (30)

7. PSYCHOLOGICAL EFFECTS. While not a "hard science" technology per se, this capability has been researched and "includes a variety of techniques which may induce debilitating fear [surprise or disorientation] in personnel...rendering them incapable or unwilling to perform the intended military action." (31)

As can be seen from this brief (but not exhaustive) survey of technologies and effects, many potential uses suggest themselves or can be directly surmised from these capabilities. Many more are available but they are basically

variations or refinements on the major categories identified here.

F. OPERATIONAL EMPLOYMENT CONCEPTS

As previously indicated, non-lethal weapons systems and associated technologies represent a new set of capabilities which can be brought to bear in a variety of situations across the operational spectrum. However, while much work has been devoted to technical research and development, comparatively little work has been done to develop the doctrine and policy which would govern and control its use.

Basically, as a new class of weapons, these capabilities are conceived of as being primarily for protection of friendly forces from attack any time during defensive or offensive operations. In addition, these weapons are to be used to "disrupt hostile combat operations throughout the depth of the battlefield in any intensity of conflict." (32)

But as a strategic or tactical employment policy, this is pretty thin gruel. It is only at the next higher level of abstraction that the current literature provides better insights on how these weapons and capabilities might be used in a future conflict. Thus, experts contend that non-lethal weapons and technologies will provide the "appropriate response when diplomacy by itself is not enough and the use of conventional force is too much." (33) Because much of this weaponry is meant to be "life conserving", we make "a moral commitment to non-lethal combat whenever possible if conflict is inevitable." (34) Future operational employment planning will have to include (at a minimum) consideration (if not an actual mix) of both lethal and non-lethal capabilities to insure mission success. In this way, commanders and political decision makers may come to see these capabilities as "weapons of first resort and lethal weapons...as last resort weapons." (35) These kinds of capabilities would prove especially useful in ambiguous situations "where the enemy is hard to identify, frequently blends in with civilians and may have a value system that rewards death and martyrdom." (36) Again, they will never fully replace conventional lethal capabilities, but adoption and use of these weapons "will round out the full spectrum of [US] capabilities and may just prove to be an irresistible alternative to conventional and/or nuclear force." (37)

When and under what circumstances would such capabilities be used? Several experts have reviewed the question and have found that these capabilities could be best used in such activities as peacekeeping operations, regional stability actions, and in counter-narcotics and counter-terrorism situations. (38) These and other applications related to land, sea and air offensive or defensive operations against adversary materiel, personnel and facilities come quickly to

mind. But beyond these more obvious applications, there are a number of related uses for these technologies, including:

- o Serving as a technical test bed for ongoing technological development.
- o Serving to extend or augment the capability envelopes of current military systems.
- o Leveraging the quantitative edge of many potential adversaries with high quality, "leading edge" capabilities.(39)

What is clear from this cursory examination of the current thinking about these technologies and weapons is that much more detailed work needs to be done to develop more robust and replete employment policies and doctrines. Some of this work can be accomplished through a review of the applicable international law of war (a "first cut" at this body of potential guidance can be found at Annex A). However, more work at the Joint Service level will be required to bring about the full integration of these systems and capabilities into individual service doctrine and training programs if the full potential of these weapons is to be realized.

III. PROGRAM MANAGEMENT AND POLICY ISSUES

A. PROGRAM MANAGEMENT ISSUES

From a variety of technical perspectives, it is obvious that there are several complex management issues to be resolved related to non-lethal weapons and technologies. While by no means exhaustive, many of the prominent issues in this area are briefly discussed below.

1. MANAGEMENT STRATEGY. Currently, most of the weapons and technologies discussed so far are being developed in a decentralized fashion among the national laboratories and within selected service development facilities. The decentralized approach is not the conscious decision of any single entity but the de facto result of a lack of such guidance. As one group expressed it, someone at "DoD [should] put someone in charge...and put all the pieces together into a cohesive program." (40) This seems to be the prevailing sentiment in much of the literature reviewed for this paper, since only by achieving "critical mass in funding and scientific effort [can one expect] to ensure success...[and to achieve] significant leverage" against competing programmatic claims.(41) If such "mass" were achieved, subsequent steps seem rather self-evident, since much of the technology is already known and under development. Thus, one of the first things that needs to be done is to assess the state of the various laboratory and service programs and to establish "a

comprehensive plan for technology development." This approach would allow for the full integration of these technologies into system architectures. These would then allow the establishment of specific functional requirements and capabilities for a more complete and robust non-lethal arsenal than we now possess. Experts envision that by establishing a joint program office, perhaps of 3-5 years' duration, we could more effectively organize current technologies, launch spin-offs, fund basic research for new and future capabilities, and exploit follow-on initiatives.(42) The assumption is that program office activities would expire once these technologies were firmly established within service inventories, and the necessary national and departmental policy, doctrine and guidance established and incorporated into our defense strategy.

2. REQUIREMENTS. As a critical subset of a consolidated management approach, weapons and technologies requirements must be developed, coordinated and established to assist in the realization of these capabilities. It is not enough to simply ask for these capabilities; to guide acquisition and procurement programs, system-level and user requirements must be established and integrated into the planning process at an early stage. Because many of these technologies are not "stand-alone" capabilities, they will have to be carefully integrated with currently-existing technologies and systems to achieve their maximum potential. Future technologies and capabilities will likewise have to be carefully managed to take advantage of future opportunities for cost or performance efficiencies. Similarly, doctrinal and procedural development will be much more rationally managed if requirements are established early on.

3. ACQUISITION AND PROCUREMENT ESTIMATES. As indicated above, many of these programs are being funded on a decentralized basis at the national and service laboratory level. To ensure complete development and life cycle support of promising technologies and weapons systems, a much more rationalized, centralized funding approach must be instituted to ensure that long-term policy and program goals are achieved on schedule. Under current peacetime circumstances, acquisition and procurement timelines for any given technology or system might be anywhere between 6 to 24 years long. In a crisis situation, these timelines could be compressed to about two years. But whatever the timeline, there is a significant time-related "cost" to the system acquisition and procurement cycle. Only a more deliberate, programmatic approach to system funding will achieve the stable acquisition and procurement environment needed to ensure that such "costs" are kept to a minimum.(43)

4. COUNTERMEASURES. While the US pursues development and possible deployment of these weapons and systems, a significant amount of effort must still be expended on

research and elaboration of countermeasures and countermeasures technologies. This is important work because, as one expert notes, for each new weapon system or technology which we develop, "the countermeasure and protection technology must also be developed." This work will not only assist us in understanding non-lethal countermeasures better, but it will also allow us to stay abreast of foreign technological developments in these areas. In this age of technological proliferation, we cannot be sure that US forces or assets will not be targeted by similar capabilities in foreign hands. (44)

5. CAUTIONS AND WARNINGS. Because of its current decentralized status (and until such time as a consolidated development program is devised), a certain amount of diffusion clouds a more penetrating understanding of many of the management problems associated with these weapons and technologies. It is therefore often difficult to know how best to approach this issue to bound and guide future progress intelligently. Those who have taken early soundings from civilian and military decision makers indicate that there is widespread interest in the field of non-lethal weapons and technologies. However, as future development proceeds (at whatever pace and however organized), there are those who wisely warn against "becoming too enamored with the concept until it [can] be proven and trusted." Indeed, experience cautions that "until we thoroughly research all aspects of this new approach", there is a danger that it could be oversold. (45)

B. POLICY ISSUES

As with the numerous management issues associated non-lethal weapons and technology, there are a wide range of policy issues which also need to be addressed. However, unlike the rather discrete categories for resolution discussed above, the main impediments to resolving the many policy issues associated with non-lethality are more doctrinal and philosophical than technical. Some of the principal policy issues for future resolution are outlined below.

1. DEFINITIONS AND IMPRESSIONS. It is clearly evident to those grappling with the concept that there is a fundamental need to more clearly define -- or even replace -- the term "non-lethal." This is important because the information indicates that while these technologies offer many humane benefits, some individuals will inevitably die from some applications. While acknowledging this problem, what needs to be stressed from the policy standpoint is that, in general, the intent of adopting these weapons and technologies is to lessen the likelihood of intentional death and unnecessary destruction which have been unfortunate and hitherto unavoidable consequences of warfare. Additionally, there needs to be work done to dispel the impression that

adoption of non-lethal weapons and technology implies some kind of weakness or disinclination to use lethal force under justifiable circumstances. The point that needs to be stressed in both cases is that the adoption of these systems and technologies represents a bold departure of defense policy and force application. The US proved during both DESERT SHIELD and DESERT STORM that it could use these technologies with great effectiveness and achieve important results. We need to reinforce the message that we will continue to defend our interests with all our capabilities, both lethal and non-lethal. (46)

2. FUTURE THREATS AND THE USE OF FORCE. Many researchers and experts have commented on the changing nature of conflict and the need to think about how future war or armed conflict will be different from past or even recent experiences. They suggest a careful analytic review of what will constitute future US national security threats and how we plan to respond to them. For some, the threats are clear-cut: regional conflicts, strategic arms proliferation, terrorism. For others, the threats are less distinct, more ambiguous, even non-traditional -- like dealing with economic entities that may or may not have the status of nation states. In tandem with a reconsideration of national security threats, we also need to consider what will constitute the use of force and how the options which non-lethal weapons and technologies offer fit into crisis and contingency management. If, in future, planners must consider threats other than those posed by physical forces, then a wide range of new action options must be developed for employment. Because of the distinct possibility that many future threats will be ambiguous, decision makers will be confronted with difficult choices about how to respond to such threats, and how to protect US lives, property and interests without a first recourse to lethal force. The complexity of these questions is further compounded by the certainty that DoD will become increasingly involved in cooperative operational and support activities with other national, state and even local agencies, themselves trying to resolve some of the same problems. The future planning environment thus places a high premium on flexibility and adaptability; our policy responses must reflect these notions also. (47)

3. EXPANDING FUTURE FORCE OPTIONS. Closely related to this last discussion is the sentiment that no one can just push these new non-lethal weapons and technologies on an unwilling or unknowing leadership: the requirement for using these capabilities must come from the top, and this "new thinking" must be applied across the spectrum of conflict. Decision makers and military commanders must be convinced that these systems and capabilities enhance the power of deployed forces and allow positive projection of force in ambiguous situations. System availability and demonstrated utility will help drive the development of new employment

doctrine and operational tactics. But these elements also need to be backed by the political will to use them to reinforce deterrence -- indeed, to use lethal force if necessary to achieve national interests. Thus, as these capabilities mature and are integrated into the force and contingency planning processes, decision makers need to understand that they represent new options for early action in a crisis, "prior to the onset of open hostilities", in the hopes of being able to roll back or even de-escalate a potential crisis. (48)

4. COMMAND, CONTROL AND RULES OF ENGAGEMENT. A set of underlying themes which need expression as policy issues relate to not only when and how these new capabilities can be used to respond to a crisis (positive control), but also to the need for appropriate rules of engagement (ROE) for their application and use. Regarding positive control, the argument runs that "since the consequences of their use are less, these weapons may be employed more freely." A related argument focuses on the increased propensity to become engaged in adventurism and interventionism, again caused by the potential power of these weapons. The remedy for these issues seems to lie in the development and promulgation of detailed rules of engagement and associated release authorities. These authorities and constraints will allow for positive control of these capabilities throughout the command structure, while steering planners and decision makers away from politically, militarily or morally ambiguous use of them, such as against one's own civilian population. But the issue which needs to be addressed is this: much work needs to be done to ensure that positive control authorities and constraints are built into force employment doctrine and personnel training programs for these systems. (49)

5. NEW POLICY AREAS. In addition to the issues raised above, new policy issues are being formulated for resolution as thinking further frames the future context of these new weapons and technologies. One rather interesting perspective on the mechanics of war with conventional lethal (as opposed to non-lethal and discriminate) weapons is the need for civilian decision makers and military commanders to consider the consequences of decisions made and options invoked during a crisis on the postwar situation, especially in the area of operations. In every major conflict in recent memory (World War II, Korea, Vietnam, Grenada, Panama, the Gulf), the US has prosecuted the war according to plan, but has fallen short in planning for the postwar consequences of its military activities. As we integrate non-lethal and discriminate weapons and technologies into service arsenals along side conventional lethal, less discriminate capabilities, planners need to consider how to deal with economic recovery issues resulting from military action. The focus of such efforts would be to ensure that force choices and applications not be so devastating that a target country or region

would not be able to recover and reintegrate itself into the international system without massive US or international aid and assistance. The size, complexity and scope of damage which modern conventional munitions can cause in even a moderately advanced Third World country need to drive some force planning considerations toward use of non-lethal and discriminate means. If national interests and force projection goals can be accomplished at a lower level of confrontation -- with lethality and damage kept to a minimum -- then a new dimension in crisis management could be opened up, and the post-crisis "sting" of so many recent memories could be somewhat abated. (50)

As is evident, above the need for thoughtful consideration and resolution of the many policy issues associated with these technologies will be an important adjunct to the development of these capabilities.

The main challenge to planners will be to meld a vigorous management strategy with concise, unambiguous policy direction to realize the full potential which these systems seem to promise. These capabilities invite our careful attention; an uncertain future international security environment demands our commitment.

FOOTNOTES

- 1: Tom Starke, "Non-lethal Weapons", (unpublished monograph, Los Alamos National Laboratory, December 1990), p. 1.
- 2: Ibid.
- 3: "Los Alamos Non-lethal Defense Concept Point Paper", (unpublished paper, Los Alamos National Laboratory, February 1991, hereafter cited as LANL), p. 2.
- 4: Starke, op. cit., p. 1.
- 5: Ibid., p. 2.
- 6: LANL, op. cit., p. 2.
- 7: US, Department of the Army, Training and Doctrine Command, Concept Guidance for Mission Kill Operations, (Ft Monroe, VA: July 1989, hereafter cited as MKO), p. 6.
- 8: Starke, op. cit., p. 2.
- 9: MKO, p. 2.
- 10: Ibid., p. 14.
- 11: LANL, op. cit., p. 3.
- 12: "Labs Rush Nonlethal Weapons for Mideast Deployment", Defense News, 5 November 1990, p. 1.
- 13: Ibid., p. 1.
- 14: "Non-lethal Summary", (unpublished paper, Defense Advanced Research Projects Agency, April 1991, hereafter cited as NLS), p. 7; MKO, p. 7.
- 15: Defense News, op. cit., p. 1.
- 16: John Alexander, "US-European Cooperation in Defense Technologies: Non-lethal Defense", (unpublished paper, Los Alamos National Laboratory, January 1991), p. 1.
- 17: Ibid., p. 1.
- 18: Starke, op. cit., p. 2.
- 19: LANL, p. 2.
- 20: Starke, op. cit., p. 3.
- 21: Ibid., p. 5.

- 22: MKO, p. 9; NLS, p. 3.
- 23: MKO, pp. 9-10.
- 24: LANL, p. 3; Alexander, op. cit., p. 4; NLS, p. 5.
- 25: Alexander, op. cit., p. 2; MKO, pp. 3-4.
- 26: Alexander, op. cit., p. 3; MKO, p. 4.
- 27: MKO, p. 3.
- 28: Alexander, op. cit., p. 2.
- 29: Ibid.
- 30: Ibid.
- 31: MKO, p. 6.
- 32: Ibid., p. 7.
- 33: Defense News, p. 1.
- 34: Ibid.
- 35: Starke, op. cit., p. 2.
- 36: Defense News, p. 1.
- 37: Ibid.
- 38: Alexander, op. cit., p. 2.
- 39: NLS, p. 6.
- 40: Defense News, p. 1.
- 41: LANL, p. 3.
- 42: Alexander, op. cit., pp. 2-4; LANL, p. 3.
- 43: Starke, op. cit., p. 2; Defense News, p. 1.
- 44: Starke, op. cit., p. 5.
- 45: Defense News, p. 1.
- 46: Alexander, op. cit., p. 5; and Alexander, "Potential Non-lethal Policy Issues", (unpublished paper, Los Alamos National Laboratory, hereafter cited as PPI), p. 2.
- 47: PPI, p. 1.

48: Defense News, p. 1.

49: PPI, p. 4.

50: Ibid., p. 6.